

A NEW GENUS AND TWO NEW SPECIES OF
EOSENTOMOIDEA (PROTURA: EOSENTOMIDAE)

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Abstract.—The genus *Styletoentomon* is erected and two new species are described, *Styletoentomon styletum* and *Eosentomon erwini*. *Eosentomon rostratum* Ewing is moved to *Styletoentomon*.

Until 1974 the suborder Eosentomoidea contained only the family Eosentomidae with a single genus, the *Eosentomon*. Tuxen (1964) in his monumental work made provisional groupings within the genus on the basis of the female squama genitalis but without setting them up as genera. In 1974, Yen described an eosentomid without spiracles from China and established a second genus, *Antelientomon*, to contain it. Tuxen (1975) erected *Isoentomon*, a third genus, to contain several species with spiniform foretarsal sensilla e and g. In 1977, Yen erected a fourth genus within the Eosentomoidea, *Anisentomon*, from China. There still remains well over a hundred species within the original genus, *Eosentomon*. All species in the four genera have chewing-type mandibles each possessing three to several small apical teeth except for *Eosentomon rostratum* Ewing (1940) and the one described herein both of which have stylet-shaped mandibles for piercing. The genus *Styletoentomon* is erected to contain these two with *Eosentomon rostratum* as the type-species.

Styletoentomon Copeland, new genus

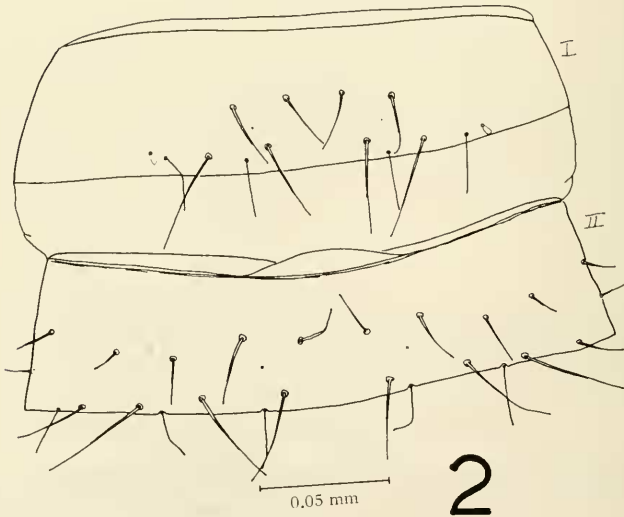
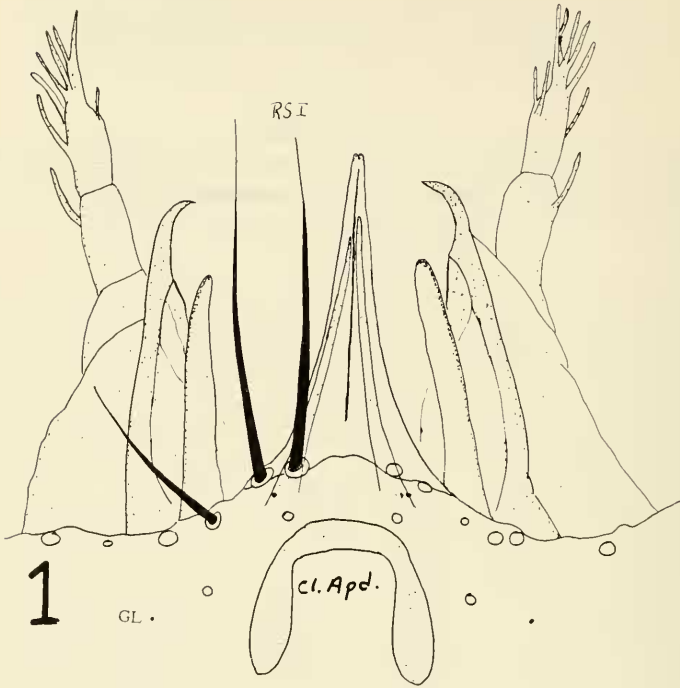
Diagnosis.—Eosentomids with spiracles and 3 pairs of 2-segmented abdominal appendages. Mandibles very long, extremely slender and sharp pointed. Labrum longer than mandibles and very narrow. Foretarsal sensilla e and g clavate. The only characters not shared by 1 or more species in the other genera are the stylet-shaped mandibles and extremely narrow labrum.

Styletoentomon rostratum (Ewing), NEW COMBINATION

Eosentomon rostratum Ewing, 1940:520.

Styletoentomon styletum Copeland, new species

This form is closely related to *Styletoentomon rostratum* (Ewing, 1940) in that they both possess long, slender, stylete-shaped mandibles and in this



Figs. 1-2. *Styletoentomon styletum*. 1, Labrum and mouthparts; RS I, rostral seta; GL, gland pore; Cl. Apd., clypeal apodeme. 2, Abdominal terga I-II.

respect differ from all other Eosentomidae. It differs from *S. rostratum* in the absence of foretarsal sensillum b'-1 and in smaller body size. Body length fully extended averages 1300 μ and foretarsal length 115 μ . In *S. rostratum* b'-1 is present, body length averages 1700 μ and tarsal length 125 μ .

Holotype.—♀, 1125 μ long but not fully distended.

Description.—Head: Almost round excluding labrum; capsule length 139 μ , with labrum 175 μ . Labrum (Fig. 1) extremely narrow and without labral setae. Mandibles rapier like and not flattened at base; rostral setae III $\frac{1}{2}$ as long as RS-I, RS-III:I = 0.53. Lacinia I poorly sclerotized, blunt tipped and not hooked; lacinia II well sclerotized and strongly hooked. Maxillary palpi resembling those of *Eosentomon vermiforme* Ewing and *S. rostratum*. Clypeal apodemes distinct, connected anteriorly.

Thorax: Three wedge-like sensilla in each pleural membrane between thorax I-II. *Filamento de sostegno* in prothorax. Mesothoracia seta P 1 shorter than distance to its homolog (35:43) and longer than P 1'. Setae-sensilla P 3' setiform.

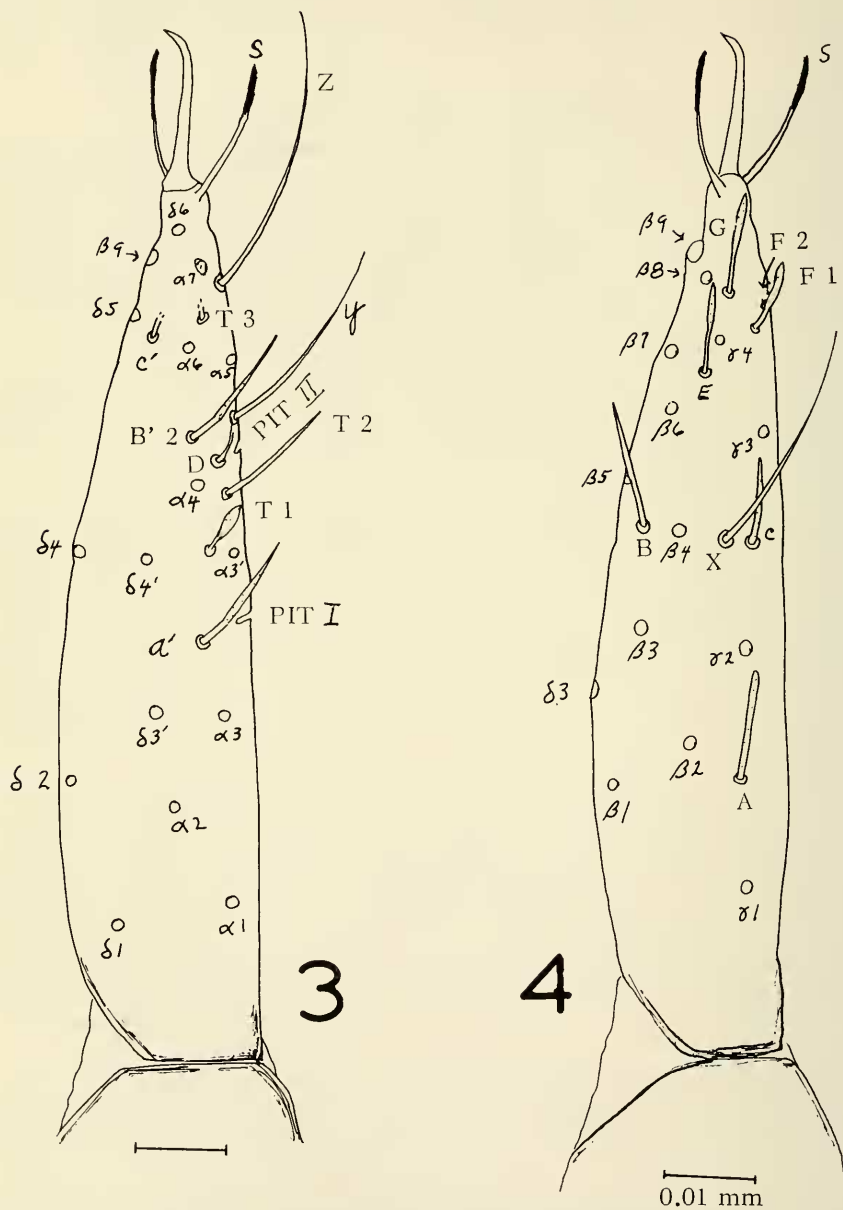
Tarsi: Foretarsus (Figs. 3-4) broader relative to length than in *E. veriforme*, length excluding claw 99 μ . Sensillum t-1 inserted on level of α 3'; t-2 setiform, long and inserted on level of α 4. Sensillum a' setiform, shorter than distance to α 4, 15:19; b'-1 absent; b'-2 setiform, broad and long; c' present but indistinct except for base; sensillum a extending $\frac{3}{4}$ distance to γ 2; b strong, tip at base of β 6; c long, not setiform; g clavate with small club, long shank, inserted near level of β 8. Tarsal pit 1 distinct and nearer a' than α 3'; pit 2 nearer d than y. Ratios: BS 1.44; TR 5.7; EU 0.90.

Tarsus III bearing the usual strong, dorsal, subapical spine; empodium very short. Claws II-III with very fine tooth on upper surface.

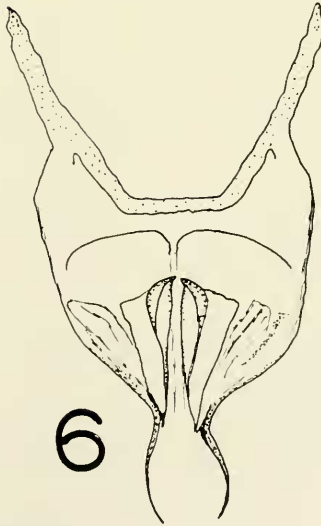
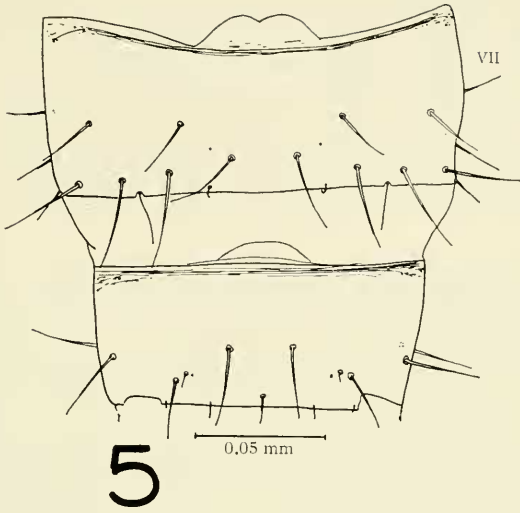
Abdomen: Posterior row of setae on tergum I (Fig. 2) with 2 primary, 2 accessory and 1 microchaeta on each side. Primary setae longer than corresponding accessories, 34:20. Seta P 1' on t VII (Fig. 5) very short, peg-like, without terminal "brush" and inserted on posterior margin of tergum. Sternum VIII with 2 anterior and 7 posterior setae, the P 2 almost in line with P 1-P 3; sterna IX-X with 4 setae each. Abdominal chaetotaxy shown in Table 1.

Genitalia: Female squama genitalis (Fig. 6) similar to that of *S. rostratum* and *E. veriforme*. The processus sternales sharp-pointed and evenly bent giving a stoop-shouldered appearance. No unusual features noted in male apparatus.

Discussion.—The most characteristic features of this species are the very long narrow labrum, stylete-shaped mandibles, prominent clypeal apodemes, the 2:2:1 seta ratio on tergum I and the absence of tarsal sensillum b'-1. The positions, shapes and sizes of the tarsal sensilla conformed closely to



Figs. 3-4. *Styletocntomon styletum*. 3, Foretarsus, dorsal view. 4, Foretarsus, ventral view.



Figs. 5-6. *Styloctenomon styletum*. 5, Abdominal terga VII-VIII. 6, Female genital apparatus.

Table 1. Abdominal chaetotaxy for *Stylectonotomon styletum*.

Abdomen	I	II-III	IV	V-VI	VII	VIII	IX-X	XI	XII
Tergum	$\frac{4}{10^a}$	$\frac{10}{16}$	$\frac{10}{16}$	$\frac{8}{16}$	$\frac{6}{16}$	$\frac{6}{9}$	—	—	—
Sternum	$\frac{4}{4}$	$\frac{6}{4}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{2}{7}$	—	—	—

^a Two primary, two accessory, and one microchaeta on each side.

those on the type as did the numbers, positions and shapes of the abdominal setae, specifically the P 1' of t VII, the P 1'' and P 2 on t VIII, the P 1-2-3 on that sternum and the 4-4 seta number on s IX-X.

The species is known from approximately 175 specimens taken at altitudes of less than 775 m in Tennessee, Arkansas, North and South Carolina and Virginia. Samples from elevations over 775 m yielded over 400 examples of the closely related form *S. rostratum* but only 10 of *S. styletum*.

Holotype and type-locality.—The holotype ♀, on slide TN 283-1 taken by T. P. Copeland from deciduous leaf litter 8 miles east of Speedwell (Claiborne Co.), TN., 21 July 1953.

Material examined.—The species is known from the holotype and paratypes from the following localities; collector, T. P. Copeland unless indicated otherwise: Speedwell, Claiborne Co., TN., 21 July 1953. Sex and slide numbers: ♀, 280-1; ♂, 281-2; 292-1; Imm., 293-1. Anderson Co., TN., 21 July 53. ♀, 287-3; Imm., 286-3. Campbell Co., TN., 21 July 53. ♀, 292-1; ♂, 293-3; Imm., 293-1. Blount Co., TN., 1 July 53. ♀♀, 98X-1; 99-1; 99-3; 99-4; 99-5; 99-6; 99-8; ♂ 99X-1. Smoky Mt. Nat. Park, Cades Cove, Blount Co., TN., 1 July 53. ♀♀, 101-15; 101-17; Imm., 101-8. Sevier Co., Dupont Mt., TN., 20 Apr. 52. ♀♀, 21-25; 21-26; ♂, 21-3; 21-28. Sequatchie Co., TN., 30 July 53. ♀, 395-1. Hamblen Co., TN., 26 July 53. Imm., 296-2 (2). Jefferson Co., TN., 20 June 59. Imm., 270-2. Lenoir City, TN., 8 Oct. 59. ♂, 520-1. Cedars of Lebanon State Park, TN., 12 Oct. 62. ♀♀, 723E-3; 723E-5; 723E-12; 724G-5, 724-4; 724-11; 724G-12; ♂♂, 723-3; 723E-7; 723E-11; 723E-15; Imm., 724-13. Shelby Forest State Park, TN., Coll. J. S. Henderson, summer, 1969. ♀, 110-1; ♂♂, 111-4; 111-5; 124-13. Chickasaw State Park, TN., Coll. G. Hunnicutt, 26 June 64. ♀♀, 25-7; 27-10; 27-13; 28-3, 30-1; 30-2, 30-4; 96-16; 109-8; ♂♂, 16-2; 27-11; 27-18; 28-6; 30-9; 30-11. Natches Trace State Park, TN., Coll. T. D. Diamond, 26 June 64. ♀♀, 1-1; 1-6; 3-6; 30-4; 40-2; 41-2; 42-1; 42-6; 42-7; 44-3; 44-4; 46-1; 48-2; 50-12; 74-1; 74-3; 74-4; 74-7; 75-1; 75-2; 75-3; 76-2; 76-3; 76-9; 76-11; 76-15; 79-3; 88-3; 98-1; 98-2; 98-6; 98-7; 98-9; ♂♂, 1-7; 3-9; 48-6; 50-14; 74-5; 75-3; 98-8; 76-5; 76-10; 98-3. Reelfoot Lake, TN.,

Coll. R. Davis. Aug. 63. ♀♀, 4-3; 4-9; 4-11; 4-12; 4-13; 4-20; 4-22; 4-24; ♂♂, 4-5; 4-7; 4-8; 4-18; 4-21; 4-23; 9-7. Highlands, No. Car., Coll. T. Copeland, 25 June 77. ♀♀, 880-1; 880-4; 881-1; ♂ 880-2; Imm., 880-7; 880-9; 880-10; 880-12; 880-14.

Deposition of type-material.—The holotype and a male paratype will be deposited in the National Museum of Natural History, Smithsonian Institution. Male and female paratypes will be given to Dr. S. L. Tuxen, Zoological Museum, Copenhagen, Denmark and to Dr. Gentaro Imadaté, Tokyo Medical and Dental University, Tokyo, Japan. The remainder will be retained by the author.

Eosentomon erwini Copeland, new species

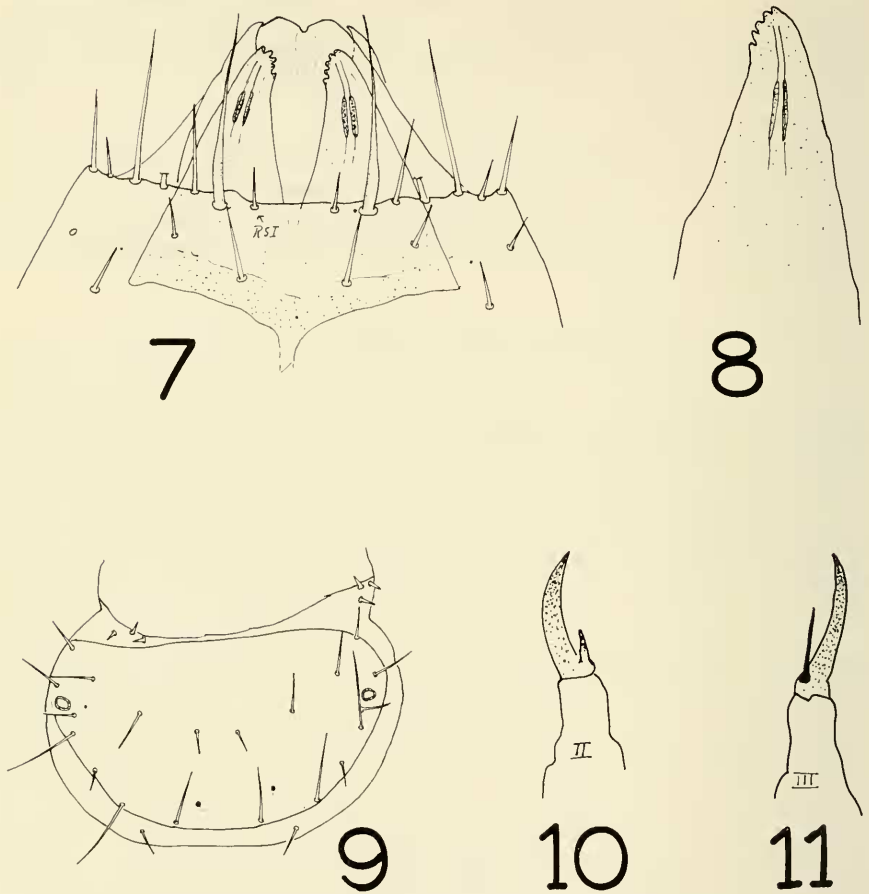
This species belongs to the *wheeleri* (2/7) group of Bonet and Tuxen (1960) and to the 3:1:1 sub-group. Its closest relatives are most likely members of the latter group and in the United States only *Eosentomon wheeleri* Silvestri, *Eosentomon pseudowheeleri* Copeland, *Eosentomon tennesseense* Copeland, *Eosentomon pusillum* Ewing, *Eosentomon quadridentatum* Copeland, *Eosentomon yosemitense* Ewing and possibly *Eosentomon christianseni* Bonet possess the requisite features.

This form can be easily differentiated from all other U.S. *Eosentomon* species by the massive size of the mouthparts, especially the mandibles. In having a long empodium on tarsus III, it resembles *Eosentomon pallidum* Ewing and *E. pusillum* but differs from those species in that *E. pallidum* has no anterior setae on sternum VIII, six setae each on sterna IX-X and t-1 inserted nearer α 3 than to α 3'. In *E. erwini* sternum VIII has two anterior setae, four setae each on sterna IX-X and sensillum t-1 inserted near level of α 3'. In *E. pusillum* the clypeal apodemes are very conspicuous, mouthparts including labrum very short, t-1 placed nearer seta α 3, body length 570 microns and foretarsus without claw 55 microns. In *E. erwini* clypeal apodemes indistinct or absent, with huge mouthparts, t-1 nearer α 3' than to α 3, body length 1500 μ and tarsal length 100 μ .

Holotype.—♀, on slide TN. 727-23, 1515 μ in length and narrow body giving a long slender appearance.

Description.—Head: Egg shaped, capsule excluding rostrum 115 μ . Labrum (Fig. 7) very wide at base and long, length 32 μ , terminating in a broad V-shaped apical notch with a wide, shallow, median cleft; LR 3.65. Pseudoculus divided and much broader than long, 15:9. Labral setae absent. Rostral setae I extremely short, 7 μ , not flattened and only $\frac{1}{2}$ as long as RS III. Rostral setae II longer than labrum and flattened (winged) in basal $\frac{1}{3}$. Mandibles (Figs. 7-8) very large and massive, terminating in 5 prominent teeth. Clypeal apodemes either absent or obscured.

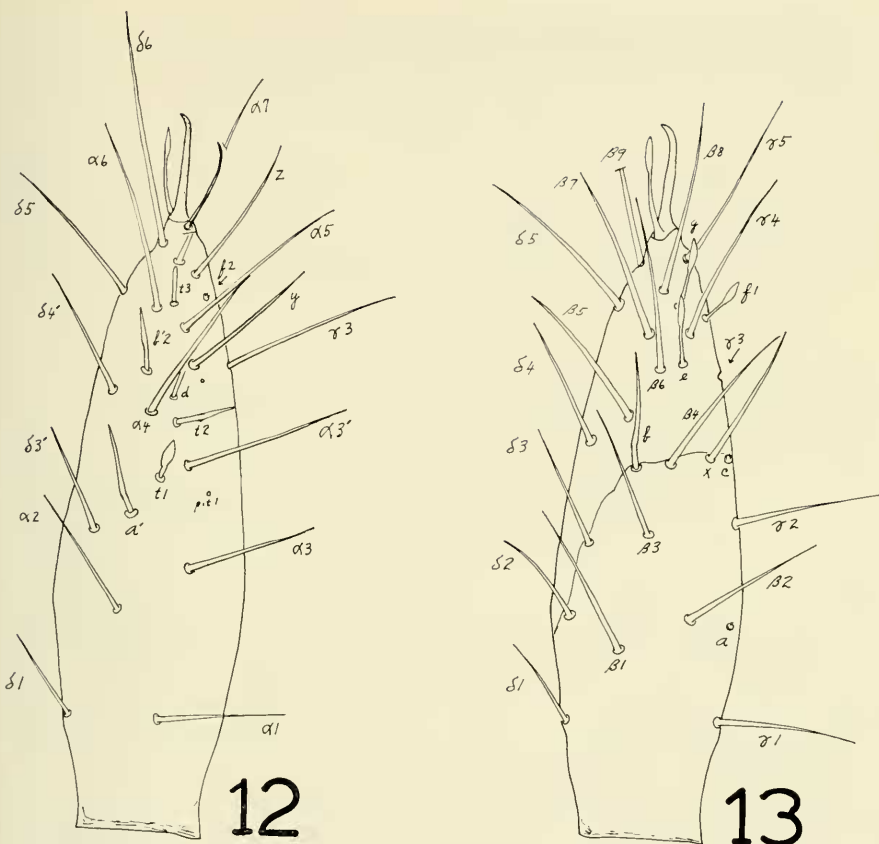
Thorax: Three prominent wedge-shaped sensilla (Fig. 9) in each pleural



Figs. 7-11. *Eoscutomon erwini*. 7, Labrum and mouthparts; RS I, rostral seta. 8, Mandible. 9, Mesothoracic tergum. 10, Tarsus II claw and empodium. 11, Tarsus III claw and empodium.

membrane between thorax I-II. Glands of *filamento de sostegno* in mesothorax: Seta P 1 on that tergum far shorter than distance to its homolog (27:35) but longer than P 1' (27:14). Tergal setae P 3' on thorax II-III long for these setae; another sensillum immediately adjacent to seta A 4 on metathorax plus 1 further removed from that seta.

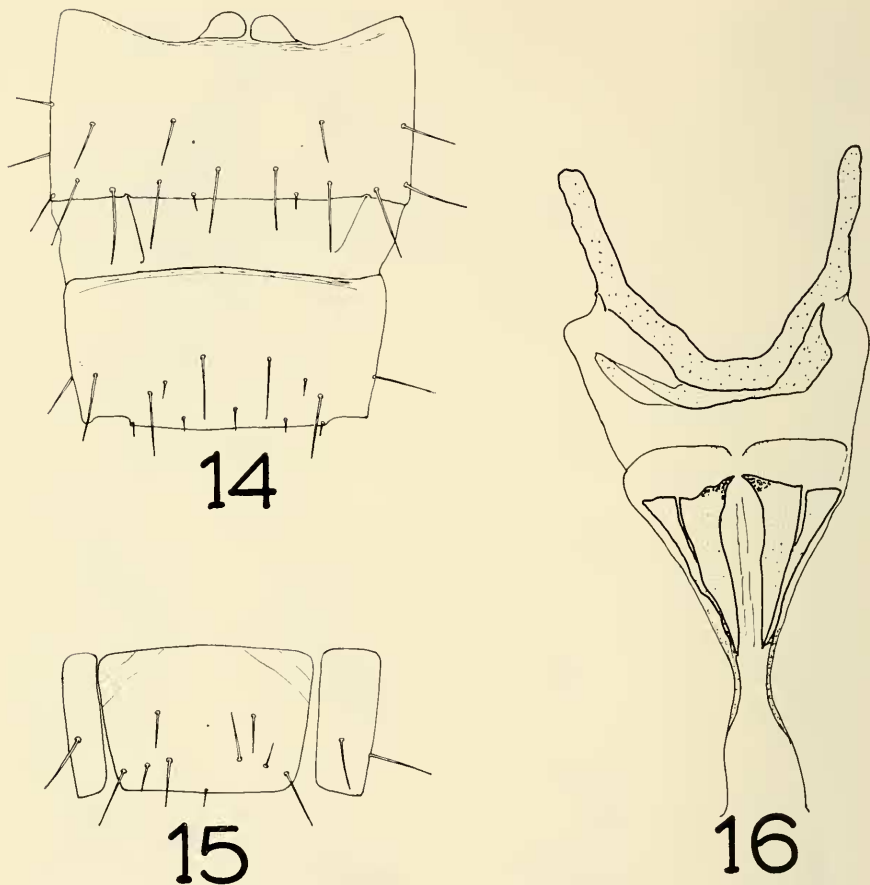
Tarsi: Foretarsus (Figs. 12-13) relatively broad, length 103 μ . The t-1 inserted slightly proximal to level of α 3'; t-2 narrow lanceolate and inserted on level of α 4; t-3 extending to base of α 7; a' setiform, tip reaching base of α 4; b'-1 absent; b'-2 lanceolate, equal length to t-2 but slightly



Figs. 12-13. *Eosentomon erwini*. 12, Foretarsus, dorsal view. 13, Foretarsus, ventral view.

broader; c' very short; sensillum a indistinct except for base but in paratypes length varied from $\frac{1}{2}$ to $\frac{2}{3}$ distance to γ 2; b setiform and extending to midpoint between β 6 and β 7; c indistinct except for socket but in paratypes varied from $\frac{1}{2}$ to $\frac{2}{3}$ distance to γ 3; e and g clavate with long shanks and small clubs; f -1 clavate, club approximately equal in size to those of c and g . Tarsal pits 1 and 2 prominent. Shapes, sizes and locations of all setae and sensilla as represented in the figures. Tarsus II empodium (Fig. 10) $\frac{1}{2}$ length of claw; tarsus III empodium (Fig. 11) longer, $\frac{2}{3}$ length of claw; claws not toothed.

Abdomen: Abdominal tergum I with 3 primary, 1 accessory and 1 microchaeta on each side in posterior row. Abdominal accessory setae longer than corresponding primaries, t IV P 1-P 1' 23:28. On t VII P 1'



Figs. 14-16. *Eosentomon erwini*. 14, Abdominal terga VII-VIII. 15, Abdominal sternum VIII. 16, Female genital apparatus.

(Fig. 14) very short setiform, not at all filamentous, inserted along the posterior margin of the tergum and not "brush" tipped. On t VIII the P 1" peg-like with long terminal filament. Sternum VIII (Fig. 15) with 2 anterior and 7 posterior setae, P 2 almost in line with P 1-P 3. Sterna IX-X with 4 setae each. Abdominal chaetotaxy represented in Table 2. Unfortunately, the type has a setal abnormality in anterior row of tergum VI, 3 on 1 side instead of 4. Paratypes have 4 on this segment.

Genitalia: The female apparatus (Fig. 16) characterized by prominent basal apodeme possessing a long plate at base; processus sternales with very sharp pointed, dense tips; posterior valves and filaments long.

Discussion.—The species is known from 61 females, 13 males and 20

Table 2. Schematic representation of abdominal chaetotaxy for *Eosentomon erwini*.

Abdomen		I	II-III	IV	V-VI	VII	VIII	IX-X	XI	XII
Tergum	a	4	10	10	8	6	6	8	8	9
	p	10 ^a	16	16	16	16	9	—	—	—
Sternum	a	4	6	6	6	6	2	4	8	12
	p	4	4	10	10	10	7	—	—	—

Abbreviations: a = anterior row; p = posterior row.

^a Three primary, one accessory and one microchaeta on each side.

immatures, an unusual ratio of females to males. There is little variation among the individuals for all characters studied. The most characteristic features are: Size and shape of labrum, massive appearance of mandibles, each with five prominent teeth; and extremely short rostral setae I giving RS III:I ratio of 2.0 and winged condition of rostral setae II. The arrangement of setae P 1-2-3 on sternum VIII is uniform in all specimens. The pseudoculi are never prominent and often difficult to find. Clypeal apodemes are either absent or obscured. Sizes, shapes and locations of all sensilla conformed closely to those on the type. Three sensilla are present in pleural membranes between thorax 1-2 on all specimens. On the foretarsus, sensillum c', when it could be clearly seen, is very short, little more than nipple-like in appearance; b'-1 is always absent; sensillum s has a very small or no club; the f-1 is always clavate, and tarsal pits 1 and 2 are prominent and uniform in location. There was no variation in the 3:1:1 seta ratio on abdomen I and in the relative lengths of primary to accessory setae, the latter being longer. On sternum VIII the P 2 is always nearly in line with P 1-P 3. In other species this is not always so but it is consistent for each species. Four adult individuals had variations in abdominal setae number but these involved only the loss of a single seta on one side. The female genital apparatus is consistently uniform in appearance except for minor distortions apparently caused by pressure from the cover glasses.

Type-locality.—Near Tennessee, State Fish Hatchery, Erwin, Tennessee. All specimens taken in leaf litter from black cherry trees and honeysuckle vines.

Types and deposition.—The holotype, ♀, on slide TN 727-23 and 93 paratypes all with numbers TN 727, collected by T. P. Copeland, 23 May 77. The type will be temporarily retained in East Tennessee State University museum but eventually it and a male will be deposited in the National Museum of Natural History, Smithsonian Institution. A paratype male and female will be deposited with Dr. S. L. Tuxen, Zoological Museum, Copen-

hagen, Denmark and Dr. Gentaro Imadaté, Tokyo Medical and Dental University. All others will be retained by the author.

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